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## EFFECT OF THE NUMBER OF TWO-WHEELED CONTAINERS AT A GATHERING POINT ON ENERGETIC WORKLOAD AND WORK EFFICIENCY

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The effect of the number of two-wheeled containers at a gathering point on the energetic workload and the work efficiency in refuse collecting was studied. The results showed that the size of the gathering point had no effect on the energetic workload. However, the size of the gathering point had an effect on the work efficiency. This study shows that an increase in work efficiency does not directly imply an increase in workload.

### INTRODUCTION

Refuse collecting is a physically demanding job and associated with a high prevalence rate of musculoskeletal disorders and a high sickness rate (Frings-Dresen *et al.* 1995a). At present, in the Netherlands most refuse is collected by means of two-wheeled containers. The number of containers at a gathering point, i.e. the place on the street where citizens place their two-wheeled container, ranges from 1 to more than 30 two-wheeled containers. In the urban areas the distance between small gathering points of up to three to four two-wheeled containers is normally covered by walking, while the distance between large gathering points of more than six two-wheeled containers is normally covered while standing on the foot-board on the back of the refuse truck. One of the possible work improvements to reduce the physical workload is to change the number of two-wheeled containers at a gathering point. Therefore, a study was performed to establish the effect of the number of two-wheeled containers at a gathering point on the energetic workload and the work efficiency.

### METHODS

Eighteen males voluntarily participated. The participants were no professional refuse collectors. Three sizes of gathering points were investigated, i.e. 2, 16 and 32 two-wheeled containers per gathering point. In every condition, a total of 96 two-wheeled containers were collected.

The task collecting of two-wheeled containers was simulated on a test circuit. The working technique, the work tempo and the weight of the container were based on a field study (Frings-Dresen *et al.*, 1995a) and controlled by a test experimenter. The energetic workload was quantified by the parameters oxygen uptake, heart rate and perceived exertion. The work efficiency was quantified as the time it took to collect 32 two-wheeled containers per time period. The acceptable amount of two-wheeled containers collected during

an 8-hour working day was based on the energetic criterion of a maximum oxygen uptake of 30%  $\text{VO}_{2\text{max}}$  (Frings-Dresen *et al.* 1995b).

### RESULTS

The size of the gathering point had no effect on the mean oxygen uptake ( $1.36 \text{ l} \cdot \text{min}^{-1}$ ), heart rate ( $104 \text{ beats} \cdot \text{min}^{-1}$ ), or perceived exertion ('somewhat to rather effortful'). However, the work efficiency was higher in the conditions with 16 and 32 two-wheeled containers at a gathering point compared to the condition with the 2 two-wheeled containers.

### DISCUSSION

What are the limitations of this study as to daily practise? First, the two-wheeled containers in this study were easy to get. In daily practise the refuse collector often has to move more than one two-wheeled container before getting a new one. This means that two-wheeled containers have to be placed in two straight lines behind each other with their handles placed to the street. Second, no kerbs and other obstacles had to be overcome in this study. Third, the pushing and pulling distance did not vary between the two-wheeled containers. This means that the distance between the two-wheeled container and the (driving) refuse truck has to be of a constant length. Fourth, the introduction of a gathering point takes a lot of (parking) space in the streets.

Because there were no significant differences between the conditions with 16 and 32 two-wheeled containers, a gathering point of 16 two-wheeled containers seems most preferable on basis of this study.

### REFERENCES

- Frings-Dresen, HMW *et al.* 1995a, The daily work load of refuse collectors working with three different collecting methods: a field study. *Ergonomics*, 38:2045-2055.
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